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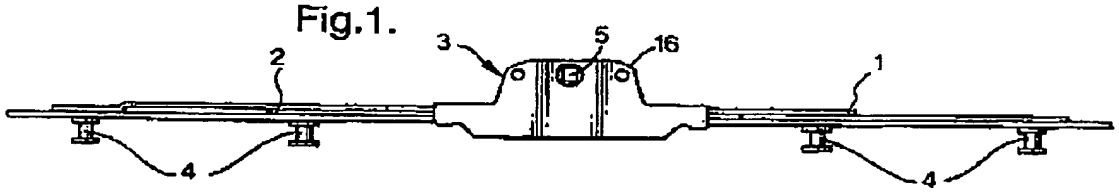
(54) **Bi-directional espagnolette bolt**

(57) An espagnolette locking mechanism for use in locking a movable leaf into a surrounding fixed frame of a window or door comprises a drive transfer mechanism (3) for connection to a rotatable handle and adapted, in use, to convert rotary movement of the handle into simultaneous translatory movement of driving elements (8, 9) in each of two opposing substantially parallel directions. Primary and secondary drive transfer members (1,2) extend on both sides of the drive transfer mechanism (3) and are connected to the driving elements (8, 9). Locking pins (4) connected to both the primary and secondary drive transfer members (1,2) are arranged in pairs on both sides of the drive transfer mechanism (3) with one of each pair being connected to the primary drive transfer member (1) and the other of each pair being connected to the secondary drive transfer member (2), so that, in use, each pair of locking pins (4) are displaced towards and away from one another upon rotation of the handle to lock and unlock the leaf and frame.

Fig.1.



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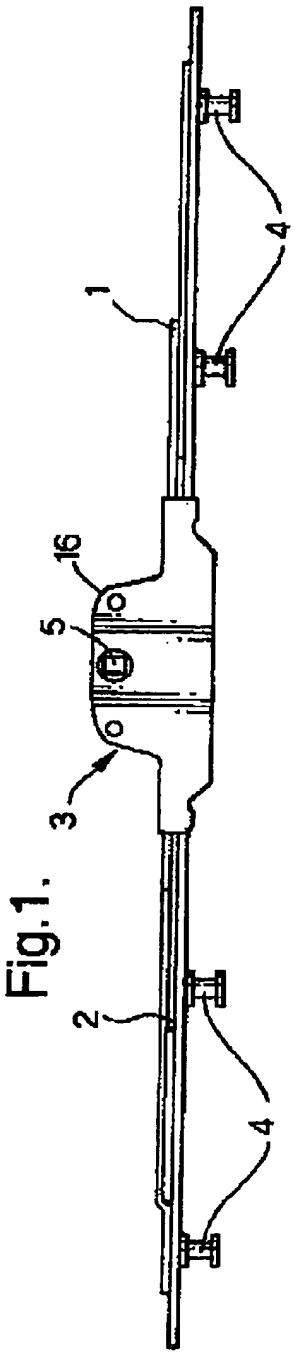


Fig.1.

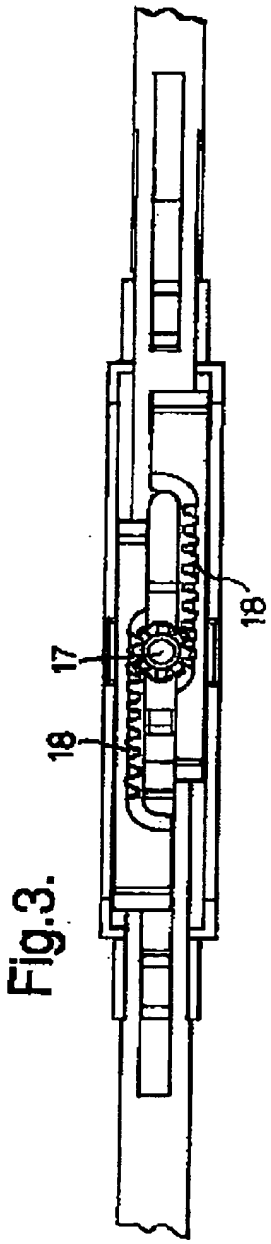


Fig.3.

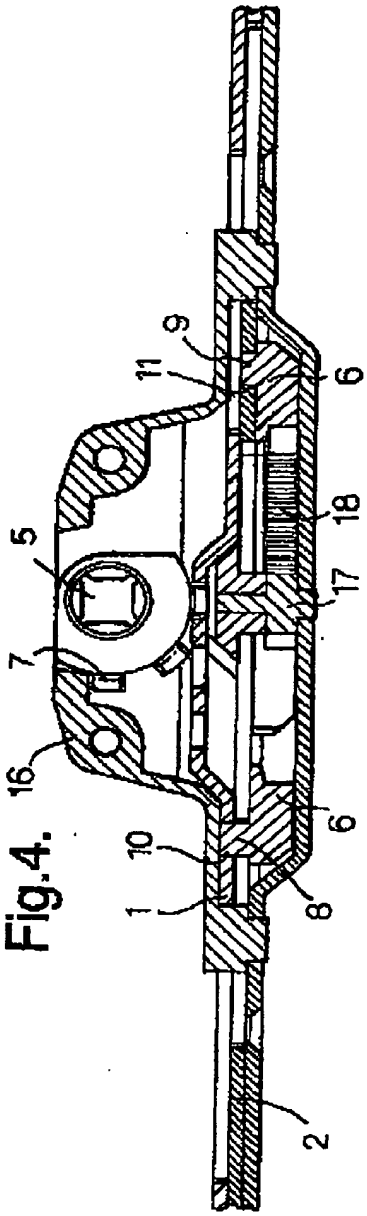


Fig.4.

Fig.2.

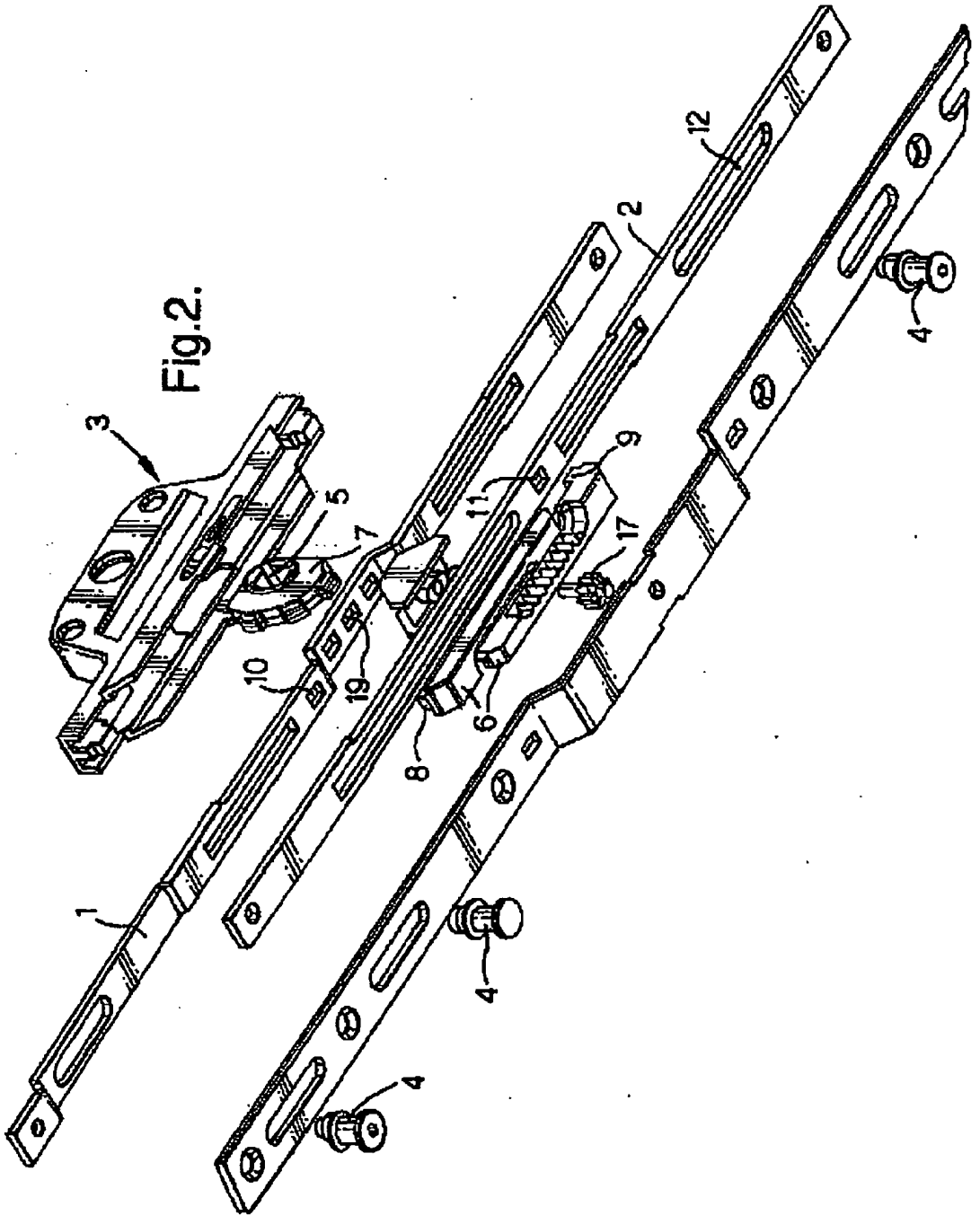


Fig.5.

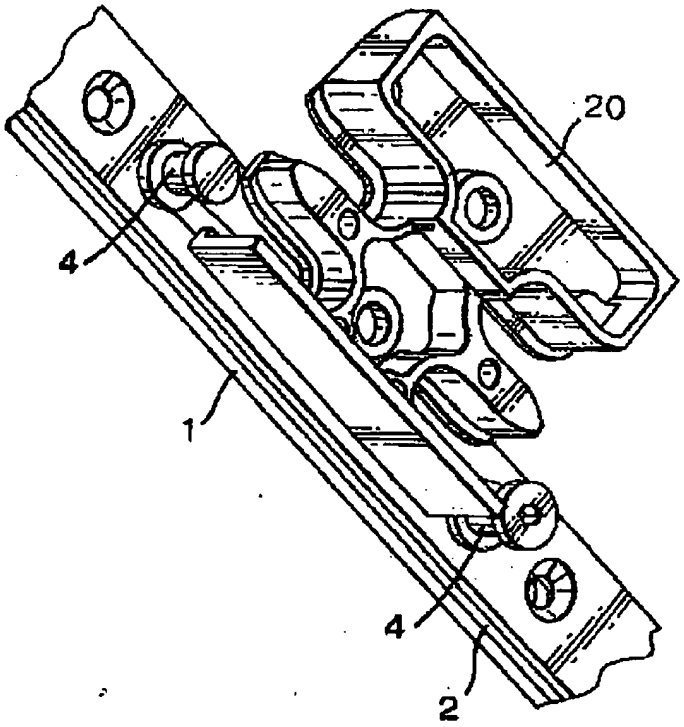
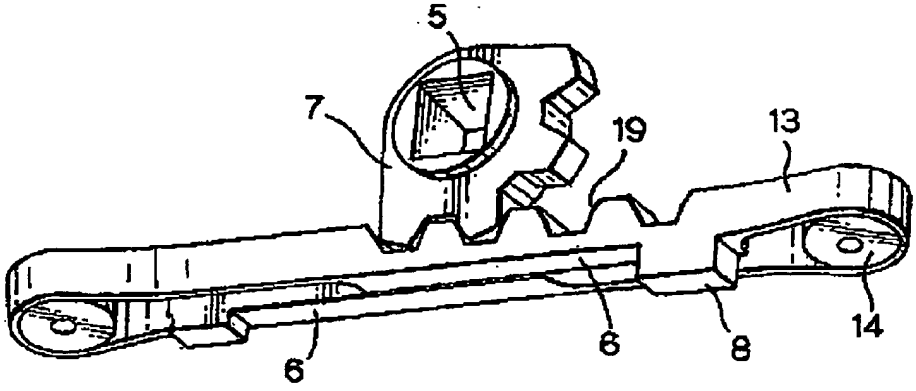


Fig.8.



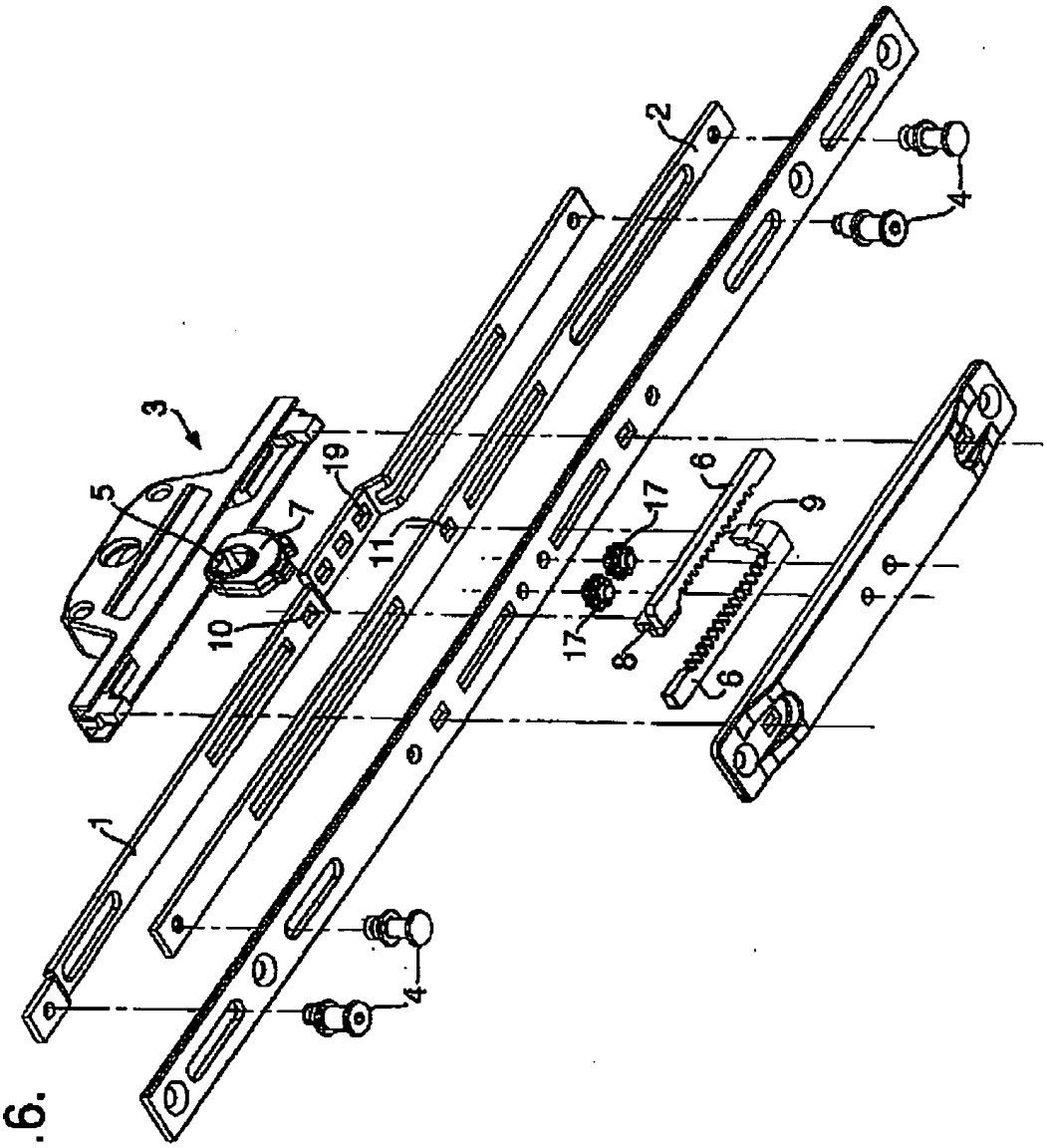


Fig.6.

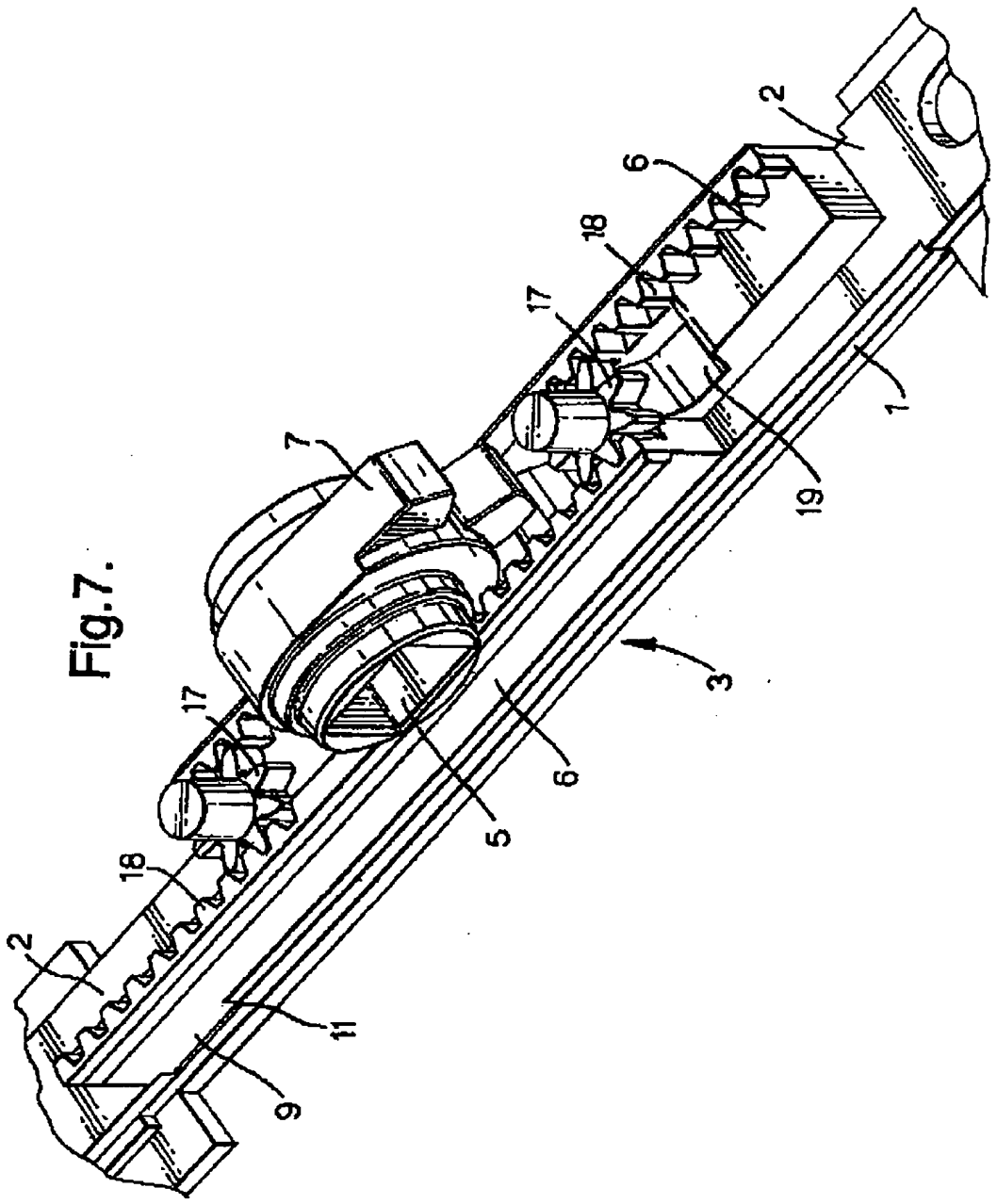


Fig.7.

Fig.9.

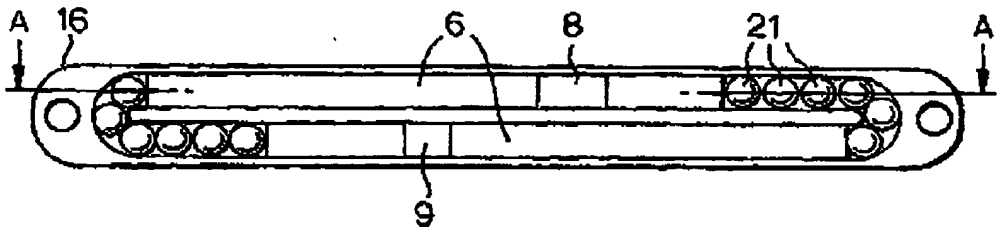
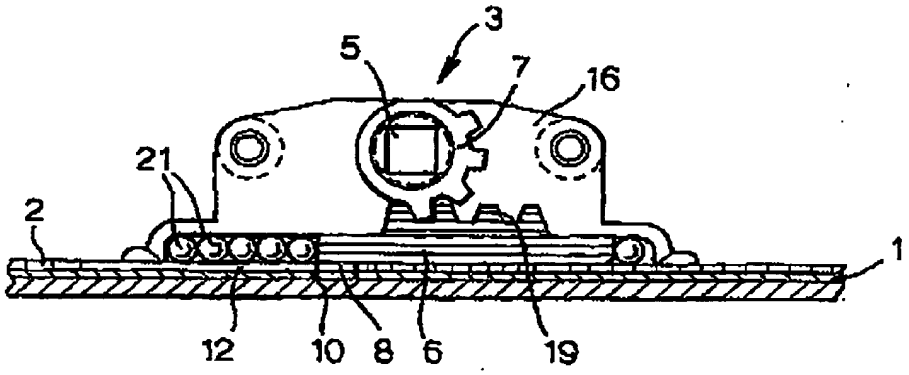


Fig.10.



Description

[0001] Espagnolette bolt mechanisms are used in doors and windows to achieve a secure fastening of the door or window and generally include a drive mechanism which transmits rotation of a handle into translational movement of an espagnolette bolt. The espagnolette bolt generally includes locking pins which engage the side of the frame adjacent the mechanism. The locking pins are usually received in a striking plate or plates attached to the fixed frame of the assembly.

[0002] Espagnolette bolt mechanisms typically provide one drive transfer member carrying the locking pins, extending on one or both sides of the drive mechanism, and which moves between a locked and an unlocked position. The drive transfer member or members are usually located in shallow grooves in the movable leaf of the window or door. A window or door fitted with an espagnolette bolt mechanism may be susceptible to forced opening. All of the locking pins in espagnolette bolt mechanisms engage in their respective striker plates from the same direction, therefore, a force applied to the window or door in an opposing direction may generate sufficient movement to disengage the locking pins and permit opening of the window or door.

[0003] Shoot bolt mechanisms typically provide two drive transfer members one extending on each side of the drive mechanism, and moving in opposing substantially parallel directions between the locked and unlocked positions. Shoot bolt mechanisms provide greater security since a forcing movement on the window or door in one direction only tends to disengage the locking pins connected to one of the two drive transfer members. The locking pins on the other drive transfer member are forced more firmly into engagement with the striker plates. Espagnolette bolt and shoot bolt mechanisms usually incorporate a plurality of locking pins on each of the drive transfer members for improved security.

[0004] According to the present invention, a bi-directional espagnolette locking mechanism for use in locking a movable leaf into a surrounding fixed frame comprises a drive transfer mechanism for connection to a rotatable handle and adapted, in use, to convert rotary movement of the handle into simultaneous translatory movement of driving elements in each of two opposing substantially parallel directions, primary and secondary drive transfer members extending on both sides of the drive transfer mechanism and connected to the driving elements, and locking pins connected to both the primary and secondary drive transfer members and arranged in pairs on both sides of the drive transfer mechanism with one of each pair connected to the primary drive transfer member and the other of each pair connected to the secondary drive transfer member, so that, in use, each pair of locking pins are displaced towards and away from one another upon rotation of the handle to lock and unlock the leaf and frame.

[0005] Preferably, the drive transfer mechanism comprises a drive pinion mounted on a housing for rotation relative to the housing by the handle, the pinion meshing with a rack forming part of or being connected to the primary drive transfer member.

[0006] Preferably, the mechanism further comprises striker plates for connecting to the fixed frame and arranged to receive and retain the locking pins in the locked position. The striker plates typically have pairs of opposite hand locking pin receiving openings. Thus each striker plate receives a pair of locking pins. Generally similar striker plates have been used conventionally to allow the same part to be used on both sides of the drive transfer mechanism when fitting espagnolette bolt mechanisms. Where bi-directional espagnolette bolt mechanisms are fitted, both of each pair of locking pin receiving openings are engaged simultaneously when, in use, the locking pins are moved towards one another. Where striker plates having more than one pair of locking pin receiving openings are fitted, a first pair of locking pin receiving openings may be used when the movable leaf is in a fully locked position in the fixed frame. A second pair of locking pin receiving openings may be used to lock the movable leaf in a position slightly ajar to allow, for example, night ventilation.

[0007] A rubber seal is usually provided between the periphery of the movable leaf and the frame to provide greater sound proofing and weather protection. The rubber seal becomes compressed between the fixed frame and the movable leaf as the window or door is closed. The degree of seal compression may be altered by adjusting the spatial relationship between the primary drive transfer member and faces of the locking pins which contact the striker plates. This may be achieved by the use of adjustable eccentric locking pins connected to the primary drive transfer members.

[0008] Locking pins connected to the secondary drive transfer member may be fixed and of a smaller gauge relative to the locking pins connected to the primary drive transfer member. Locking pins connected to the secondary drive transfer members should be substantially unloaded under normal operation of the mechanism. However, if the movable leaf is forced either in a direction substantially parallel but opposite to the locking direction of movement of the secondary drive transfer members or transversely out of the frame, the locking pins connected to the secondary drive transfer members engage the striker plates located on both sides of the drive transfer mechanism and resist movement of the movable leaf relative to the fixed frame.

[0009] The locking pins connected to the primary and secondary drive transfer members ensure that the bulk of the locking forces are applied through the primary drive transfer member and therefore, driving elements connected thereto also have to transmit the bulk of the locking forces. Thus, a driving element driving the primary drive transfer member, therefore, should be of a substantially grater cross-section to have a greater

strength than a driving element driving the secondary drive transfer member. By forming the rack integrally with the primary drive transfer member, it can be ensured that the maximum possible force can be transferred from the pinion to the primary drive transfer member.

[0010] In order to provide a compact, easy fitting, versatile mechanism, the secondary drive transfer member preferably overlays the primary drive transfer member, the primary drive transfer members lying closest to the drive transfer mechanism. Driving elements may be connected to the drive transfer members via protrusions extending from the driving elements engaging with cut away portions of the drive transfer members. When the driving elements are remote from the pinion the driving element connecting with the primary drive transfer member is longer than that connecting with the secondary drive transfer member.

[0011] Preferably, end portions of the drive transfer members project beyond guide members which are fixed at corners of the movable leaf, for engagement with shoot bolt keeps on opposite ends or sides of the fixed frame when the mechanism is in the locked position, and where the end portions of the drive transfer members are retracted into the guide members when the mechanism is in the unlocked position.

[0012] In one embodiment, the drive transfer mechanism comprises a plastics band with driving elements and the rack driven by the pinion is formed integrally in the band. Preferably, the band is tensioned around the two spaced rollers each rotatable on spindles. Preferably, the band is made from a filled nylon.

[0013] In another embodiment, the drive transfer mechanism comprises a closed loop track of constant cross sectional width with a centreline forming a shape containing two substantially parallel adjacent sides and two semicircular ends. A centre spine separates the two parallel adjacent sides of the track. The track contains ball bearings and two driving elements. The cross sectional width of the track is equal to the width of one of the driving elements or the ball bearings. Translatory movement of a driving element having a drive rack by the pinion, forces all of the ball bearings to move around in the track causing translatory movement of the other driving element in a substantially parallel but opposite direction.

[0014] It is preferred however, that the drive transfer mechanism includes a reversing mechanism to provide equal and opposite movement between the primary and secondary drive transfer members. In this case the reversing mechanism includes two driving members each having a rack formed on them and at least one gear rotatable about a fixed axis meshing with the racks. Where the pinion meshes directly with the primary transfer member one of the driving members is connected to and driven by the primary transfer member but, alternatively, the pinion meshes directly with a rack formed on one driving member and then this is connected to the primary transfer member. In both cases, the other driving member is connected to and drives the secondary transfer member.

[0015] The gear wheel or wheels may rotate about an axis parallel to the axis of the pinion but preferably it or they rotate about an axis normal to the axis of the pinon and thus normal to a plane, containing the directions of movement of the driving members. Preferably, the or each gear wheel and/or the driving member are made of steel for strength.

[0016] Particular embodiments of the present invention will now be described with reference to the accompanying drawings in which:

Figure 1 is a side elevation of a first embodiment of a bi-directional espagnolette locking mechanism;
Figure 2 is an exploded perspective view of the first embodiment;
Figure 3 is a partial view of the drive mechanism of the first embodiment;
Figure 4 is a partial cross-section view of the first embodiment;
Figure 5 is a partial perspective view showing the engagement with a striker plate;
Figure 6 is an exploded perspective view of a second embodiment;
Figure 7 is a partial perspective view of a third embodiment with the housing of the drive transfer mechanism removed;
Figure 8 is a partial perspective view of a fourth embodiment showing movable parts of the drive transfer mechanism only;
Figure 9 is an underneath plan view of the drive transfer mechanism of a fifth embodiment; and,
Figure 10 is a partial section view of the present invention taken along line A-A of Figure 9.

[0017] Referring to the drawings there is shown a mechanism which includes a drive transfer mechanism 3 for connection to a rotatable handle which fits into a square hole 5. The drive transfer mechanism 3 is adapted, in use, to convert rotary movement of the handle into simultaneous translatory movement of driving members 6 in each of two opposing substantially parallel directions. A primary drive transfer member 1 and secondary drive transfer member 2 extend on both sides of the drive transfer mechanism 3. The drive transfer members 1 and 2 are connected to the driving members 6. The drive transfer members 1 and 2 move in a groove at the end face of a window or door.

[0018] Locking pins 4 are connected to both the primary and secondary drive transfer members 1 and 2. The locking pins 4 are arranged in pairs on both sides of the drive transfer mechanism 3 with one of each pair connected to the primary drive transfer member 1 and the other of each pair connected to the secondary drive transfer member 2. In use, rotation of the handle causes movement of the primary and secondary drive transfer

members 1 and 2 in opposing substantially parallel directions and causes each pair of locking pins 4 to move towards and away from one another.

[0019] The pairs of locking pins 4 are positioned to move into and out of engagement with striker plates 20 (shown in Figure 5) connected to the fixed frame. Each pair of locking pins 4 engages and disengages with a pair of locking pin receiving openings, one of each pair of locking pin receiving openings located on each of two opposite faces of the striker plate 20, when, in use, each pair of locking pins 4 move towards or away from one another.

[0020] The locking pins 4 connected to the primary drive transfer member 1 are eccentrically adjustable to allow adjustment of the location of a centre of the locking pins 4 relative to the primary drive transfer member 1 in order to permit adjustment of the seal compression of the movable leaf in the fixed frame when in the locked position. The locking pins 4 connected to the secondary drive transfer member 2 are fixed and of a smaller gauge compared to the locking pins 4 connected to the primary drive transfer member 1.

[0021] The primary drive transfer member 1 overlays the secondary drive transfer member 2 such that the primary drive transfer member 1 lies nearest a pinion 7 and the secondary drive transfer member 2 lies furthest from the pinion 7. A cut away portion 12 in the secondary drive transfer member 2 allows a locking pin 4 connected to the primary drive transfer member 1 to protrude through the secondary drive transfer member 2.

[0022] The driving members 6 are connected to the drive transfer members 1 and 2 via driving elements 8 and 9 engaging with cut away portions 10 and 11. The adjustable eccentric locking pins 4 connected to the primary drive transfer member 1 ensure that the bulk of the force transferred from the drive transfer mechanism 3 to the drive transfer members 1 and 2 is carried by the primary drive transfer member 1.

[0023] The pinion 7, having the square hole 5 therein, is mounted on a housing 16 of the drive transfer mechanism 3. The pinion 7 has three teeth for engagement with a rack 19 formed by cut-away portions formed integrally in the primary drive transfer member 1. Rotation of the handle causes the pinion 7 to rotate and corresponding translatory movement of the primary drive transfer member 1.

[0024] Figure 2 shows in detail the drive transfer mechanism 3. Both of the driving members 6 have toothed racks 18 facing inwardly for meshing engagement with a gear wheel 17 rotatable about an axis normal to a plane containing the directions of movement of the driving members 6. The gear wheel 17 may be made from steel or other suitable material. The driving members 6 rest adjacent the secondary drive transfer member 2. Translatory movement of the driving member 6 connected to the primary drive transfer member 1 causes translatory movement of the other driving element6 in a substantially parallel opposite direction.

[0025] Assembly of the locking mechanism described is easily achieved since the components may be assembled in a "drop-down" configuration. The driving members 6 and small gear wheel 17 are positioned on a support member for fixing to the window or door. The secondary and primary drive transfer members 2, 1 are then located on the driving elements 8, 9. Finally, the drive transfer mechanism 3 having the drive pinion 7 is connected to the primary drive transfer member 1, and the locking pins 4 fixed to the drive transfer members 1, 2. By positioning the driving members 6 external from the drive mechanism housing 16 it is possible to provide driving members 6 of greater strength when compared with those located within the housing 16 as shown in the third example, since there is a decreased space constraint.

[0026] A further feature of the present invention may be to extend the drive transfer members 1 and 2 beyond guide members which are fixed at corners of the movable leaf, for engagement with shoot bolt keeps on opposite ends or sides of the fixed frame when the mechanism is in the locked position, and where the end portions of the drive transfer members 1 and 2 are retracted into the guide members when the mechanism is in the unlocked position.

[0027] The second embodiment is generally similar to the first but, in this example, the driving elements 6 are formed by a punching and pressing operation from steel sheet and a pair of gears 17 is included. This arrangement is both cheaper to make and stronger than the arrangement shown in the first and third embodiments which rely on die castings for the driving members 6.

[0028] A third embodiment is generally similar to the first and second but in this embodiment a drive rack 19 meshes with the pinion 7 instead of the pinion 7 meshing directly with the primary drive member 1. The drive rack 19 is formed integrally with the driving member 6 which is connected to the primary drive transfer member 1. Both of the driving members 6 have toothed racks 18 facing inwardly for meshing engagement with two gear wheels 17 rotatable about parallel but spaced axes normal to a plane containing the directions of movement of the driving elements 6. The use of two gear wheels 17 can give an increased throw of driving elements 6 but mainly it shares the load and so increases the strength of the mechanism. The driving member 6 and the driving element 9 connected to the primary drive transfer member 1 have substantially greater dimension to have a greater strength than the other driving member 6 and element 8.

[0029] The fourth embodiment of the present inventions shown in Figure 8. The drive transfer mechanism 3 in this embodiment comprises the pinion 7, a drive rack 19 and driving elements 8 and 9. The driving elements 8 and 9 are formed integrally in a flexible plastics band 13. The band 13 may be made from a filled nylon or other suitable material. The band 13 is tensioned around two rollers 14 each rotatable on spindles 15 mounted on the

housing 16 of the drive transfer mechanism 3 such that the rollers 14 may rotate about parallel but spaced axes normal to the plane containing the directions of movement of the driving elements 8 and 9. Translatory movement of the driving element 8 with the drive rack 19 causes translatory movement of the other driving element 9 in a substantially parallel opposite direction. The driving element 8 is connected to the primary drive transfer member 1 and is of a substantially greater dimension to have a greater strength than the other driving element 9 connected to the secondary drive transfer member 2.

[0030] Figure 9 and 10 show a fifth embodiment of the present invention. The drive transfer mechanism 3 comprises pinion 7, drive rack 19, driving members 6 and driving elements 8 and 9. A closed loop track of constant cross sectional width has a shape containing two substantially parallel adjacent sides and two semicircular ends. A centre spine separates the two parallel adjacent sides of the track. The track contains ball bearings 21 and the driving members 6. The cross sectional width of the track is equal to the width of one of the driving members 6 or the ball bearings 21. Translatory movement of the driving member 6 having the drive rack 19 and driving member 8 forces causing translatory movement of the other driving member 6 having the driving element 9 in a substantially parallel opposite direction.

Claims

1. A bi-directional espagnolette locking mechanism for use in locking a movable leaf into a surrounding fixed frame comprising:

   a drive transfer mechanism (3) for connection to a rotatable handle and adapted, in use, to convert rotary movement of the handle into simultaneous translatory movement of driving elements (8, 9) in each of two opposing substantially parallel directions;
   primary and secondary drive transfer members (1,2) extending on both sides of the drive transfer mechanism (3) and connected to the driving elements (8, 9); and,
   locking pins (4) connected to both the primary and secondary drive transfer members (1,2) and arranged in pairs on both sides of the drive transfer mechanism (3) with one of each pair connected to the primary drive transfer member (1) and the other of each pair connected to the secondary drive transfer member (2), so that, in use, each pair of locking pins (4) are displaced towards and away from one another upon rotation of the handle to lock and unlock the leaf and frame,
   the drive transfer mechanism (3) comprising a drive pinion (7) mounted on a housing for rotation relative to the housing by the handle, the pinion (7) meshing with a rack (19) forming part of or being connected to the primary drive transfer member (1).

2. A mechanism according to claim 1, further comprising striker plates (20) for connecting to the fixed frame and arranged to receive and retain the locking pins (4) in the locked position.

3. A mechanism according to any one of claims 1 or 2, wherein the locking pins (4) connected to the primary drive transfer member (1) are eccentrically adjustable and wherein the locking pins (4) connected to the secondary drive transfer member (2) are fixed and are of a reduced gauge relative to the locking pins (4) connected to the primary drive transfer member (1).

4. A mechanism according to any one of the preceding claims, wherein the primary drive transfer member (1) overlays the secondary drive transfer member (2) such that the primary drive transfer member (1) lies nearest the pinion (7) and the secondary drive transfer member (2) lies furthest from the pinion (7).

5. A mechanism according to any one of the preceding claims, wherein a driving element (9) extending from one of the driving members (6) connecting said driving member (6) with the primary drive transfer member (1) is substantially longer than a driving element (8) extending from the other driving member connecting said driving member (6) with the secondary drive transfer member (2).

6. A mechanism according to any one of the preceding claims, wherein there exists a cut away portion (12) on the secondary drive transfer members (2) to allow the driving element (9) extending from one of the driving members (6) connected with the primary drive transfer member (1) unobstructed translatory movement when the mechanism is in use.

7. A mechanism according to any one of the preceding claims, wherein end portions of the drive transfer members (1, 2) project beyond guide members which are fixed at corners of the movable leaf, for engagement with shoot bolt keeps on opposite ends or sides of the fixed frame when the mechanism is in the locked position, and where the end portions of the drive transfer members (1,2) are retracted into the guide members when the mechanism is in the unlocked position.

8. A mechanism according to any one of the preceding claims, wherein the drive transfer mechanism (3) includes a reversing mechanism (6, 17) to provide equal and opposite movement between the primary and secondary drive transfer members.

9. A reversing mechanism according to claim 8, in which the reversing mechanism includes two driving members (6) each having a rack (18) formed on them and at least one gear (17) rotatable about a fixed axis meshing with the racks (18), where the pinion (7) meshes directly with the primary transfer member (1) one of the driving members (6) is connected to and driven by the primary transfer member (1) but, alternatively, the pinion (7) meshes directly with a rack (19) formed on one driving member (6) and then this is connected to the primary transfer member (1).

10. A mechanism according to claim 9, wherein the gear wheels (17) and driving members (6) are made of steel.